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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/517,314	03/02/2000	Chih-Chen Cho	M4065.0223/P223	5039

7590

01/11/2002

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EXAMINER

KANG, DONGHEE

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 01/11/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/517,314

Applicant(s)

CHO, CHIH-CHEN

Examiner

Donghee Kang

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 October 2001.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-18,20-32 and 39 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-18,20-32, and 39 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 08 August 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Acknowledgement

1. Applicant's Amendment and Response to Paper No.11 has been entered and made of Record. Claims **1, 3-18, & 20-32** are pending in this Office Action.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims **1, 3, 9-12, 15-16, 18, 22-27 & 30-32** are rejected under 35 U.S.C. 103(a) as being unpatentable over Park (US 6,303,486).

Park discloses a semiconductor device comprising (Fig.18):

an insulator layer (1105); a conductive plug (1125) positioned within said insulator layer and formed of a single conductive material; an etch stop layer (1110) located on said insulator layer and surrounding said plug, wherein said etch-stop layer comprises silicon nitride; an intermediate non-conductive layer (1810) provided over said etch stop layer and having at least a first and a second etched via over said plug, wherein said second etched via is above and has a greater diameter than said first etched via; a conductive connector formed in said first and second etched via in electrical contact with said plug and including a first conductive layer (1525) deposited in and in contact with said first and second etched via and a second conductive layer

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(1440) deposited over and in contact with said first conductive layer, said first conductive layer including a portion in contact with said conductive plug, wherein said first conductive layer comprises titanium nitride. *See also Clo.7, line 55-Col.10, line 49.*

Although Figure 18 does not show an active region in substrate, Park teaches the substrate 1100 may be an underlayer of semiconductor material, such as a silicon substrate or wafer or alternatively underlayer of semiconductor device as shown in Fig.20, such as a layer of metal oxide semiconductor field effect transistors (MOSFETs). *See Col.7, lines 47-54.*

Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to connect the conductive plug 1125 to the active region, such as source/drain region, in MOSFETs device in order to provide an electrical connection with other elements such as power source.

Park does not explicitly teach a processing unit which is coupled to a semiconductor device. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have a processor unit in processor-based device, since the processor is required in the processor-based device to operate a device.

4. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Park (US 6,303,486) in view of Chiang et al (US 5,739,579).

Park does not disclose the non-conductive layer (etch-stop layer) comprising a silicon carbide. Chiang teaches in Fig.9 the silicon carbide layer acts as an etch-stop layer.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the silicon nitride of Park's device with silicon carbide layers as taught by Chiang in order to provide the etch stop layer in the device. Furthermore, one of ordinary skill in the art would have recognized that the silicon nitride and silicon carbide are both considered to be an art recognized functional equivalent for serving as an etch-stop layer in the device.

Moreover, it would have been obvious to one having ordinary skill in the art at the time the invention was made to form the etch-stop layer, *having the materials as claimed*, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

4. Claims **5-6, 17, & 39** are rejected under 35 U.S.C. 103(a) as being unpatentable over Park (US 6,303,486) in view of Wang et al (US 6,184,128).

Regarding claim **5**, Park does not disclose the non-conductive layer (etch-stop layer) comprising a silicon dioxide. Wang et al teach in Fig.7 the silicon dioxide layer acts as an etch-stop layer (Col.5, lines 49-64).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the silicon nitride of Park's device with a well known silicon dioxide as taught by Wang et al in order to provide the etch stop layer in the device. Furthermore, one of ordinary skill in the art would have recognized that the

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silicon nitride and silicon dioxide are both considered to be an art recognized functional equivalent for serving as an etch-stop layer for BPSG dielectric layer.

Regarding claim 6, Park does not teach the non-conductive layer (etch-stop layer) comprising silicon nitride and silicon carbide. However, Wang et al teach in Fig.7 etch stop layer (13) includes the silicon nitride and silicon carbide layer (Col.5, lines 49-64).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the silicon nitride of Park's device with silicon nitride and silicon carbide layers as taught by Wang et al in order to provide the etch stop layer in the device. Furthermore, one of ordinary skill in the art would have recognized that the silicon nitride and silicon dioxide are both considered to be an art recognized functional equivalent for serving as an etch-stop layer for BPSG dielectric layer.

Moreover, it would have been obvious to one having ordinary skill in the art at the time the invention was made to form the etch-stop layer, *having the materials as claimed*, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Regarding claims 17 & 39, Park does not teach a plurality of memory cells. It would have been obvious to one having ordinary skill in the art at the time the invention

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was made to form a plurality of memory cells in order to obtain a high density memory device.

5. Claims **7-8, 13-14, 20-21, & 28-29** are rejected under 35 U.S.C. 103(a) as being unpatentable over Park (US 6,303,486) in view of Hong et al (US 6,008,117).

Park discloses substantially the entire claimed structure, as applied to claims 1, 11, 18 & 25 above, except for non-conductive layer comprises borophosphosilicate glass (BPSG). However, Hong et al teaches in Fig.1H the non-conductive layer disposed on the etch-stop layer comprises BPSG. *See also Col.3, lines 16-19.*

It is well known and conventional to form dielectric layer using BPSG in the art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the SiO₂ of Park's device with a conventional BPSG material as taught by Hong in order to provide a dielectric layer which has a less etch rate than etch-stop layer. Furthermore, one of ordinary skill in the art would have recognized that the SiO₂ and BPSG are both considered to be art recognized functional equivalent for providing a dielectric layer and therefore an obvious expedient. Moreover, it would have been obvious to one having ordinary skill in the art the invention was made to form the dielectric layer, *having the materials as claimed*, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Response to Arguments

6. Applicant's arguments with respect to claims **1, 3-18, & 20-32** have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Donghee Kang whose telephone number is 703-305-9147. The examiner can normally be reached on Monday through Friday.

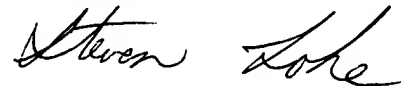
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Donghee Kang, Ph.D.
January 9, 2002

Steven Loke
Primary Examiner

A handwritten signature in black ink, appearing to read "Steven Loke", written in a cursive style.